

High-transmission recovery in slow-light-range in photonic crystal waveguide using hetero group-velocity waveguide

Y.Kitagawa¹, N.Ozaki¹, Y.Takata¹, N.Ikeda^{1,2}, Y.Watanabe¹, A.Mizutani¹,
Y.Sugimoto^{1,2}, and K.Asakawa¹,

¹Center for TARA, Univ. of Tsukuba, Tsukuba, Ibaraki 305-8577, Japan.

²Ultrafast Photonic Devices Lab., AIST, Tsukuba, Ibaraki 305-8568, Japan.

A slow light due to the low group velocity (L-Vg) in a two-dimensional photonic crystal (2D-PC) waveguide (WG) enhances optical nonlinearity (ONL) as a result of the long light-matter interaction, while it degrades a high-transmission in the WG due to a large impedance mismatch at the WG edge. Here, we propose a hetero-Vg (Ht-Vg) WG for solving this problem. The Ht-Vg structure consists of a L-Vg region between identical high-Vg (H-Vg) regions, as shown in Fig.1 (a). Vg's were controlled by changing air-hole diameters. The resultant transmittance for the Ht-Vg WG exhibited a 16dB recovery as compared with the conventional homogeneous-Vg WG, as shown in Fig.1(b). The corresponding group index (n_g) in the L-Vg region, measured by the cross-correlation method, achieved more than 20. The results indicate an effectiveness of the Ht-Vg WG for large ONL-based 2D-PC devices.

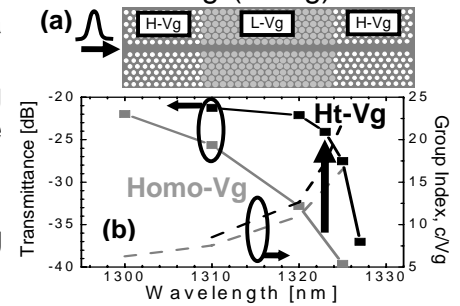


Fig.1 (a) Schematic of the Ht-Vg WG. (b) Measured transmittance (solid line) and group index (dashed line) of slow light in Ht-Vg and homo-Vg WGs.